



# Progress Report

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## Progress Report for *Natural Attenuation of BTEX and Chlorinated Aliphatic Hydrocarbons in Groundwater at Naval Air Station North Island*

The Naval Facilities Engineering Service Center (NFESC) and Southwest Division (SWDIV) are currently managing an innovative approach to natural attenuation under the Broad Agency Announcement (BAA) program, and the Navy Environmental Leadership Program (NELP).

Site 5 at NAS North Island in San Diego, California has historically been used as a surface disposal area for chlorinated aliphatic hydrocarbons (CAHs) and other industrial wastes. Parsons Engineering Science, Inc. was selected to model the natural attenuation process for CAHs and to monitor and track natural attenuation at Site 5 (Figure 1).

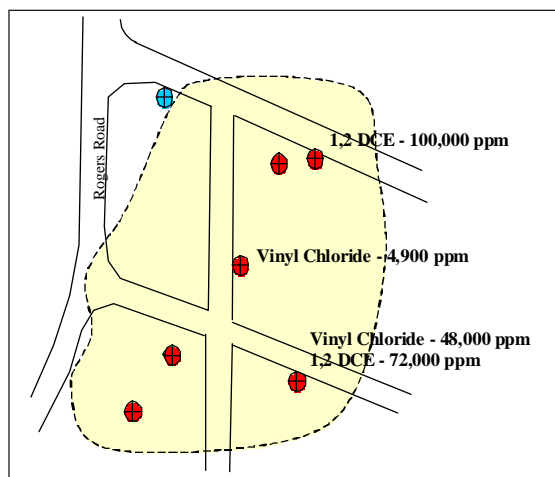


Figure 1. Groundwater plume, North Island IR Site 5.

**Natural Attenuation.** Natural attenuation, also known as intrinsic bioremediation, is a passive remediation method. This method can reduce petroleum and chlorinated hydrocarbon contamination toxicity, mobility, and volume to levels in soil and groundwater that do not pose a threat to human health and the environment. Mechanisms for natural attenuation include the processes of dispersion, sorption, biochemical stabilization, volatilization, advection, dilution from recharge, and abiotic chemical transformation.

Biodegradation will occur as microorganisms transform hydrocarbons for energy and cell production. The biodegradation process will occur in the presence of oxygen, nitrate, ferric iron, sulfate, or carbon dioxide fixing bacteria. Two biodegradation scenarios are possible with vinyl chloride either being oxidized to CO<sub>2</sub> or reduced to ethene and ethane (Figure 2).

### Scenario 1 - Vinyl Chloride Oxidation



### Scenario 2 - Vinyl Chloride Reduction



Figure 2. Biodegradation sequence for CAHs.

**NOTE:** This document is for informational purposes only and is not an endorsement. Applicability for remediation must be evaluated on a site-specific basis.

### Advantages of Natural Attenuation

- Contaminants are transferred to innocuous byproducts (carbon dioxide, organic acids, ethene, or water) and not just transferred to another phase or location.
- Current pump and treat technologies are energy intensive (costly) and not effective in reducing residual contamination.
- The process is non-intrusive and allows for continued use of the infrastructure during remediation.
- Since natural attenuation is an in situ technology, there is no threat of exposure during remediation.

**Demonstration Goals.** Goals of this demonstration project are to show the following occurrences:

- (1) Prepare a record of data showing that the outward velocity of the contaminant plume is shrinking or has reversed.
- (2) Document the loss of contaminant mass using chemical and geochemical data.
- (3) Document loss of contaminant mass using a tracer to calculate biological decay rates.
- (4) Generate laboratory data that supports the occurrence of biodegradation.

**Field Demonstration.** The field demonstration for this project (see “Milestones/Accomplishments”) began in October 1997 and is scheduled for completion in October 1998. Specific activity phases planned for the demonstration are:

**Field Collection of Data.** Ten monitoring wells are installed and data will be collected to support studies of current natural attenuation rates and to develop a fate and transport model for the contaminant plume.

**Fate and Transport Modeling.** A model will be prepared that will:

- (1) Predict the migration and future extent of the dissolved contaminant plume.
- (2) Assess the potential for contaminant concentrations to exceed levels that are protective of human health and the environment.

- (3) Provide an additional tool to be used in the assessment of natural attenuation as a potential remedial alternative at the site.

**Risk Analysis.** An exposure pathway analysis will be performed based upon the results of the natural attenuation evaluation and fate and transport modeling. The analysis will include potential human and ecological receptor identification.

**Long-Term Monitoring Plan.** If natural attenuation is determined to be a viable alternative for the site, a long term monitoring plan will be presented in the report.

### Milestones/Accomplishments

Awarded contract .....	12 Aug 1997
Installed and sampled wells .....	6 Oct 1997
Developed fate and transport model .....	24 Oct 1997
Perform quarterly monitoring .....	Dec 1997 to Jul 1998
Recalibrate fate and transport model .....	Jul 1998
Submit final report .....	Oct 1998

For more information on this demonstration project, contact:

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